

UNITED STATES PATENT APPLICATION

FOR

**IMPROVED LIGHT GUIDE PANEL
AND METHOD OF USE**

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IMPROVED LIGHT GUIDE PANEL AND METHOD OF USE

FIELD OF THE INVENTION

The present invention relates generally to the light guide panels and more particularly to an improved light guide panel utilized with display devices.

BACKGROUND OF THE INVENTION

Light guide panels are utilized in keyboard assemblies to backlight the keypads of the keyboard. Typically, such light guide panels utilize a bundle of optical fibers to backlight the keyboard assembly. Figure 1 is a simplified block diagram of a conventional light guide panel 10. As is seen, an optical fiber bundle 12 is provided there within. The fiber bundle 12 receives light via a ferrule 14. The light for illuminating the fiber bundle is provided via at least one light emitting diode (LED) 16.

When LED 16 is activated, a fiber-mat 18 is illuminated to provide backlighting for the keyboard. The top surface of the fiber-mat 18 is abraded to let a controlled amount of light emit from top surface. The top surface of the fiber-mat 18 is abraded to provide a uniform distribution of light out of the top surface. Much light is lost out of the end of the fiber-mat 18, which is not recaptured.

In addition to the inefficient lighting issues associated with conventional light guide panels, there is also a problem with the size of the panel when utilizing such a panel. As is seen, in the conventional panel 10, each fiber of the fiber bundle 12 must bend at with at least a minimum curvature value to allow light to be provided to the particular fiber. As a result, the radius of curvature shown at 19 must be at least some minimum value to allow for light to come in. For example, for an optical fiber bundle that radius must be 0.5 inch or so to allow

for enough light to be brought in to illuminate the fiber mat 10.

Accordingly, this 0.5 inch of radius of curvature adds a $\frac{1}{2}$ 0.5 inch of width onto the panel 10 in the direction, as is shown. As is well known, it is desirable to reduce the size of a keyboard, especially for portable devices, in any way possible. Hence, providing a light guide panel which does not increase the size of the keyboard assembly is desirable.

Accordingly, what is needed is a light guide panel that has increased illumination over conventional light guide panels when in use but does not add to or increase the size of the keyboard. The system must be easy to use, compatible with existing devices and cost effective. The present invention addresses such a need.

Another common technique for providing backlighting is to use a light-guide panel (clear sheet of plastic with texture or printed ink to disperse the light as needed. However, in the existing light guide panels, the sources for illumination are placed beyond the perimeter of the lighted area. This increases the overall form-factor of the light guide panel and is undesirable.

SUMMARY OF THE INVENTION

A light guide panel is disclosed. The panel comprises a plate for dispersing light and at least one light-emitting diode (LED) coupled to the plate for providing the dispersed light.

When the panel is coupled to a keyboard, the at least one LED is under a portion of the keyboard such that when the at least one LED is illuminated, the light from the LED does not distract a user. Accordingly, by strategically placing LEDs within the panel and providing the LEDs under appropriate portions of the keyboard, the device utilizing the keyboard can be smaller than when a conventional light guide panel is utilized. In addition, a further improvement in illumination is provided when a mechanism is provided which reflects light

escaping from the edges of the panel back into the panel.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a simplified block diagram of a conventional light guide panel.

5 Figure 2 illustrates a first embodiment of a light guide panel in accordance with the present invention.

Figure 3 illustrates a second embodiment of a light guide panel in accordance with the present invention.

Figure 4A illustrates a conventional light guide panel.

10 Figure 4B illustrates an embodiment of the light guide panel in accordance with the present invention, in which the ends of the panel appear as jagged.

DETAILED DESCRIPTION

15 The present invention relates generally to the light guide panels and more particularly to an improved light guide panel utilized with display devices. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiment and the generic principles and features described herein will be readily apparent to those skilled in the art. Thus, the present invention is not intended to be
20 limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

A light guide panel in accordance with the present invention comprises a plate for dispersing light and a plurality of light emitting diodes coupled to the plate, wherein the panel

is coupled to the keyboard, the plurality of light emitting diodes are under a portion of the keyboard such that the light from the LEDs does not distract a user. In so doing, the form factor of the light guide panels can be smaller than conventional light guide panels and more light is emitted thereby. To further describe the features of the present invention, refer now to the following description of this invention with the accompanying drawing.

Figure 2 illustrates a first embodiment of a light guide panel 100 in accordance with the present invention. The light guide panel 100 includes a plate 102. The plate 102 includes a plurality of optical fibers 123 therein. The light guide panel 100 further includes a plurality of light emitting diodes (LEDs) 104 coupled to the plate 102 and which provide light to the optical light guide panel 123 to backlight the keyboard. In this embodiment, the LEDs 104 are under the opaque space bar 120 (shown in outline form) of the keyboard 122 (also shown in outline form). In so doing, there are no bright spots on the keyboard when the LEDs 104 are illuminated. By providing the LEDs 104 directly within the plate 102 rather than through the fiber optic bundle as in the conventional light guide panel 10 of Figure 1, the size of the light guide panel 100 is reduced, and in addition, the illumination is improved.

In the embodiment of Figure 2, the space bar 120 is used to prevent bright spots. However, one of ordinary skill in the art recognizes that there could be a variety of other places that the LEDs could be located and their use would be within the spirit and scope of the present invention. The key feature is that the LEDs are under a portion of the keyboard that will not distract a user.

Figure 3 illustrates a second embodiment of a light guide panel 200 in accordance with the present invention. Four LEDs 202a-202d are located on specific points of a light guide panel 202 with opaque portions 203 there over. By strategically placing the LEDs in the

appropriate place there is a more even distribution of light. The LEDs could be placed, for example, under a logo, a number keypad or other appropriate portion of the keyboard. In so doing, there may be a bright spot, but it will not distract the user. It should be understood that although four LEDs are shown in this figure, one of ordinary skill in the art recognizes that any number of LEDs could be utilized and their use would be within the spirit and scope of the present invention.

To further improve upon the illumination characteristics of the light guide panel, a system and method in accordance with the present invention includes a mechanism for increasing the total usage of light within the light guide panel and decreasing wasted light emission. Referring now to Figure 4A, which is a simplified illustration of a conventional light guide panel 300, the light escapes at the ends of the panel based on the edges being straight thereon, and including no means to reflect the escaping light back into the panel. With the ends 302 being straight, the light, instead of being reflected in any fashion, will simply be transmitted out the ends 302 of the panel 300.

In a system and method in accordance with the present invention, as seen in Figure 4B, the ends 402 of the panel 400 are jagged in appearance (the jagged ends are exaggerated). Through reflection of the light from the jagged ends, the light is reused which allows for more illumination since the total internal reflection value is greater. There are a variety of mechanisms that could be utilized to make the ends of the panel reflect the light back into the panel. Another method for reflecting the light back into the panel is to provide sheet metal flanges (which may be inexpensively manufactured as part of the keyboard metal base plate) which are parallel to the edges of the light guide panel. The light escaping from the panel is reflected off of the sheet metal surfaces and back into the light guide panel.

Accordingly, the system that utilizes a mechanism that optimizes the reflection at the edges of the panel, in combination with the LEDs being strategically placed will provide for a smaller form factor for the keyboard assembly as well as an improvement in light and illumination.

5 Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.